

WHAT IS CLAIMED IS:

1 1. A method for treating a diseased region of a blood vessel to a
2 desired tissue treatment temperature range, the diseased region of the blood vessel having
3 occlusive material between a vessel lumen and a vessel wall, the method comprising:
4 measuring a thickness of the occlusive material between the vessel lumen
5 and the vessel wall;
6 positioning a balloon catheter within the vessel lumen adjacent the
7 occlusive material;
8 selecting an outer surface temperature to compensate for the thickness of
9 the occlusive material, the outer surface temperature being lower than the target tissue
10 temperature range;
11 introducing a cooling fluid into the balloon catheter such that the cooling
12 fluid vaporizes and cools an inner balloon catheter surface, an outer balloon catheter
13 surface being disposed over the inner balloon catheter surface;
14 controlling vaporization within the balloon so as to cool the outer surface
15 of the balloon catheter below the target tissue temperature range according to the selected
16 outer surface temperature such that the temperature of the vessel wall is within the target
17 temperature range.

1 2. The method of claim 1, further comprising inhibiting heat transfer
2 between the inner balloon surface and the outer balloon surface.

1 3. The method of claim 2, wherein the heat transfer inhibiting step
2 comprises disposing an insulation material between the cooling fluid and the outer
3 balloon catheter surface.

1 4. The method of claim 1, wherein the occlusive material measuring
2 step is performed using intravascular ultrasound (IVUS).

1 5. The method of claim 1, wherein the desired tissue treatment
2 temperature range is between about -5C and -25C.

1 6. The method of claim 1, wherein the selecting step decreases outer
2 surface temperatures with increasing occlusive material thicknesses.

- 1 7. The method of claim 1, wherein the vaporization controlling step
- 2 comprises cycling a cooling fluid supply valve according to a regular period on/off cycle.